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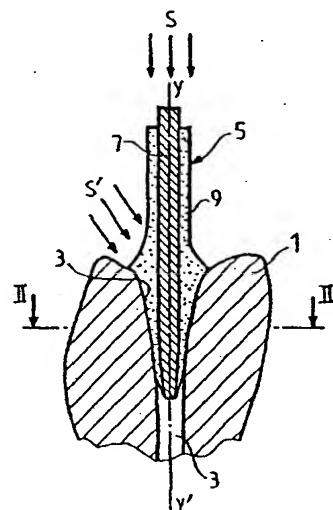
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(54) RENFORT DENTAIRE AUTOBLOQUANT.

(57) La présente invention concerne un renfort dentaire
destiné à être mis en place, notamment, dans une cavité
dentaire (3).

Ce dispositif est caractérisé en ce qu'il comporte des
moyens de rigidité axiale et longitudinale (7), dont au moins
la partie destinée à être fixée dans ladite cavité (3), com-
porte, au moins en périphérie, un produit durcissable (9) en
mesure de fluer sous l'action d'une contrainte, de façon à
épouser la forme des parois de la cavité (3) dans laquelle il
est mis en place, ce produit étant apte à durcir, après son
introduction dans ladite cavité (3).



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La présente invention concerne un renfort dentaire, et notamment un tenon, dont la forme externe est apte à épouser la forme d'une cavité, ou du canal, d'une dent où l'on souhaite le fixer.

5 On sait qu'en odontologie on utilise des tenons en métal ou en matériau composite pour réaliser une reconstitution d'une dent dépulpée.

Ces tenons, quelle que soit leur constitution, ont une section droite circulaire, si bien que lorsqu'on les met en place
10 dans des canaux dentaires dont la section droite est de forme différente ils ne viennent en appui que par une faible partie de leur surface externe contre la paroi interne de la dent. Le blocage mécanique du tenon n'est donc pas assuré de façon efficace, si bien que l'on est parfois contraint de parfaire le
15 blocage en introduisant dans les espaces libres existant entre la dent et le tenon des produits de reconstitution ou de scellement divers.

En fait, lorsque le praticien souhaite disposer d'un ajustement parfait du tenon dans un canal dentaire ovoïde, il est
20 contraint de prendre une empreinte canalaire de grande précision, par exemple en silicone, et de faire réaliser par un laboratoire de prothèse un tenon dit anatoforme en métal coulé, ce qui présente l'inconvénient d'être onéreux et de nécessiter trois opérations successives sources d'imprécisions, à savoir la prise
25 d'une empreinte de grande précision, la réalisation dans cette empreinte d'un tenon en cire et finalement la coulée de ce tenon en métal avec le risque de surdimensionnement à la coulée.

La présente invention a pour but d'améliorer à la fois la facilité et la qualité de mise en place d'un renfort dentaire en proposant un tel renfort qui soit en mesure d'épouser la forme de la cavité, ou du canal dentaire, où on souhaite le disposer.

5 La présente invention a ainsi pour objet un renfort dentaire destiné à être mis en place, notamment, dans une cavité dentaire, caractérisé en ce qu'il comporte des moyens de rigidité axiale et longitudinale, dont au moins la partie destinée à être fixée dans ladite cavité, comporte, au moins en périphérie, un
10 produit durcissable en mesure de fluer sous l'action d'une contrainte, de façon à épouser la forme des parois de la cavité dans laquelle il est mis en place, ce produit étant apte à durcir, après son introduction dans ladite cavité.

Suivant l'invention le renfort peut être constitué
15 notamment d'un tenon, ou d'un faux moignon adaptable sur un tenon solidarisé d'une dent. Le renfort peut également être constitué d'une pièce unique formant à la fois le tenon et le faux moignon.

Dans un mode de mise en oeuvre de l'invention les moyens de rigidité axiale et longitudinale sont constitués par un noyau
20 rigide formé notamment de fibres longues noyées dans une résine de synthèse. De telles fibres peuvent de préférence être transparentes et on fera ainsi appel notamment à des fibres de verre ou de quartz.

Dans un autre mode de mise en oeuvre de l'invention,
25 ledit renfort est de type durcissable par polymérisation sous l'action d'un rayonnement lumineux. Ce mode de mise en oeuvre est particulièrement intéressant en ce qu'il permet au praticien de disposer de tout le temps qui lui est nécessaire pour mettre en

place le renfort dans la dent de son patient et faire fluer, au cours de cette mise en place, le produit durcissable dans la cavité dentaire qu'il est destiné à remplir.

Suivant l'invention le produit peut également être de
5 type durcissable par réaction chimique ou sous l'action d'un rayonnement haute fréquence, ou de micro-ondes.

On décrira ci-après, à titre d'exemple non limitatif, une forme d'exécution de la présente invention, en référence au dessin annexé sur lequel:

10 La figure 1 est une vue en coupe axiale et longitudinale d'un renfort suivant l'invention, constitué d'un tenon mis en place dans un canal dentaire.

La figure 2 est une vue en coupe transversale du tenon représenté sur la figure 1 suivant la ligne II-II de celle-ci.

15 La figure 3 est une vue en coupe axiale et longitudinale d'une variante de mise en oeuvre d'un renfort suivant l'invention constituée d'un tenon.

La figure 4 est une vue en coupe axiale et longitudinale d'une autre variante de mise en oeuvre d'un renfort suivant
20 l'invention constituée d'un tenon.

La figure 5 est une vue en coupe axiale et longitudinale d'un renfort suivant l'invention, constitué d'un faux moignon, avant la mise en place de celui-ci sur un tenon solidarisé d'une dent.

25 La figure 6 est une vue en coupe axiale et longitudinale d'une dent équipée du faux moignon représenté sur la figure 5.

La figure 7 est une vue en coupe axiale et longitudinale d'une variante de mise en oeuvre d'un renfort suivant

l'invention, formant à la fois tenon et faux moignon avant sa mise en place dans une dent.

La figure 8 est une vue en coupe axiale et longitudinale du renfort représenté sur la figure 7 après sa mise en place sur la dent.

On a représenté sur la figure 1 une dent 1 comportant un canal ovoïde 3 dont on a agrandi la partie supérieure, de façon à y loger un tenon 5 suivant l'invention.

Le tenon 5 est constitué d'une âme centrale et longitudinale 7 d'axe yy' qui est transparente et qui est formée d'un faisceau de fibres longues, telles que des fibres de quartz ou de verre, qui sont noyées dans une matrice de résine durcissable, notamment une résine transparente telle qu'une résine époxy.

La périphérie de l'âme 7 est recouverte d'un produit malléable 9 possédant la propriété de durcir sous l'action d'un rayonnement lumineux, et notamment d'un rayonnement dont la longueur d'onde est telle qu'il se situe dans le domaine de la lumière visible. Les produits de ce type sont parfaitement connus dans la technique dentaire et l'on pourra ainsi notamment utiliser une résine triéthylène glycol diméthacrylate (dite TEGDMA) ou une résine bisphénol aglycidyl diméthacrylate (dite BISGMA).

On donnera au produit durcissable 9 des caractéristiques telles qu'il puisse être déformé et fluer facilement lorsqu'on le soumet à une contrainte, de façon que, lorsque le tenon 5 prend place dans le canal 3, il puisse assurer le remplissage du volume vide autour de lui.

Afin de donner au produit durcissable la compacité nécessaire, on pourra lui ajouter des microcharges, notamment de la silice pyrogénée ou colloïdale, ce qui permettra de lui conférer des caractéristiques thixotropiques.

5 Par ailleurs on pourra également charger ledit produit durcissable, en plus des charges de silice, avec des charges telles que des fibres courtes disposées et orientées de façon aléatoire dans ledit produit. On pourra également, en fonction des application spécifiques, ajouter au produit des macrocharges
10 constituées notamment de particules de quartz ou de microsphères creuses de verre. De préférence, suivant l'invention, les différentes charges contenues dans le produit seront constituées de matériaux transparents.

Dans ces conditions la mise en oeuvre de l'invention se
15 fera ainsi que décrit ci-après.

Une fois que le praticien a terminé la préparation canalai-
re du canal dentaire 3 et le mordantage et le séchage de celui-ci, il applique un apprêt d'adhésif dit " Primer " et un adhésif sur la paroi externe du tenon 5 ainsi que sur les parois
20 canalaires, puis il introduit celui-ci dans le canal dentaire 3. Sous l'effet de la force d'application nécessaire à la bonne mise en place du tenon 5, les parties du produit durcissable 9 qui rencontrent les parois du canal 3 fluent et viennent ainsi remplir les volumes vides compris entre le tenon 5 et la paroi
25 interne du canal 3, ce qui permet de remplir des orifices notamment de type ovale, ainsi que représenté sur la figure 2. Après que le praticien a contrôlé la mise en place correcte du tenon 5, il éclaire l'extrémité externe de celui-ci à l'aide

d'une source de lumière S, et notamment d'une source de rayons de longueur d'ondes du domaine visible, pendant le temps nécessaire au durcissement complet du produit 9. Les rayons lumineux suivent l'âme transparente 7 du tenon 5 pour éclairer sur leur passage et
5 par l'intérieur la gaine externe de produit photodurcissable 9, ce qui assure le durcissement de celui-ci. Dès lors le blocage du tenon 5 est ainsi assuré.

Lorsque le produit durcissable 9 est de nature transparente, ainsi que précisé précédemment, le praticien peut
10 alors réaliser la photopolymérisation en éclairant, ainsi que représenté sur la figure 1, avec une source de lumière S' disposée près de la jonction entre le tenon 5 et la surface de la dent 1. Cette disposition permet d'obtenir une action plus efficace du rayonnement lumineux sur le produit durcissable 9,
15 dans la mesure où le trajet du rayonnement à travers le tenon est plus faible.

Comme représenté sur la figure 3 il n'est pas nécessaire que le produit durcissable 9 soit disposé en épaisseur égale sur la totalité de la périphérie de l'âme centrale 7 du tenon 5. On
20 pourra ainsi se limiter à ne disposer celui-ci que dans la partie dite canalaire du tenon 5, c'est à dire celle qui est destinée à prendre place dans le canal dentaire 3. Une telle disposition apporte une grande facilité d'emploi en ce qui concerne la préhension.

25 Dans un autre mode de mise en oeuvre de l'invention représenté sur la figure 4 le tenon 5 comporte une âme rigide 7 formée de fibres longues transparentes 11 qui s'étendent sur toute sa longueur. Ces fibres 11 longues confèrent au tenon la

rigidité qui est nécessaire à sa mise en place dans le canal dentaire 3. Des rétentions 13, obtenues notamment par usinage, ont été réalisées autour de l'âme 7 de façon à créer sur la périphérie de celle-ci des aspérités favorisant l'accrochage du produit durcissable 9.

Ainsi que représenté sur les figures 5 et 6, le renfort suivant l'invention peut également être constitué d'un faux moignon 20, qui est destiné à prendre place sur un tenon 5' fixé dans une dent 1. A cet effet la partie supérieure de la dent 1 entourant le tenon 5 est creusée d'une cavité 22 destinée à recevoir la base du faux moignon 20.

Ce dernier est constitué d'une âme rigide 23 dont la partie inférieure est de forme tronconique et qui est creusé d'un canal axial et longitudinal 24, d'un diamètre interne correspondant au diamètre externe du tenon 5', de façon que le faux moignon 20 puisse s'enfiler sur celui-ci. La périphérie 9' du faux moignon 20 est recouverte d'un produit 9' apte à fluer et qui possède la propriété de durcir sous l'action d'un rayonnement lumineux et notamment d'un rayonnement visible ou ultraviolet, du type de celui utilisé dans le mode de mise en oeuvre précédent. Ce produit s'étend sur toute la hauteur du faux moignon 20, si bien que la forme externe de celui-ci est une forme cylindrique et que sa partie inférieure comporte une plus grande quantité du produit durcissant 9'.

Dans ces conditions la mise en place sur la dent du faux moignon 20 s'effectue ainsi que précisé ci-après.

Le faux moignon 20 est enfilé sur le tenon 5', de façon que son canal axial 24 reçoive celui-ci, et est fortement

appliqué contre la dent 1, dans le sens des flèches G, si bien que, sous cet effort, le produit 9' flue et remplit l'espace compris entre les parois externes de la cavité 22 et celles du faux moignon 20. Comme mentionné précédemment, on éclaire ensuite
5 le produit 9' à l'aide d'un rayonnement lumineux, notamment un rayonnement visible ou éventuellement ultraviolet, de façon à le faire durcir. On obtient ainsi par une mise en oeuvre particulièrement facile et rapide un scellement d'un faux moignon sur une dent, dans lequel tous les espaces libres existant entre
10 la dent et le faux moignon sont comblés d'un produit durci si bien que le faux moignon est maintenu de façon particulièrement efficace sur le tenon 5' et la dent 1.

Dans une variante de mise en oeuvre, représentée sur les figures 7 et 8, un renfort 29 suivant l'invention est constitué à
15 la fois d'un tenon scellé dans la dent et d'un faux moignon. Ainsi, sur la figure 7 le renfort 29 est constitué d'une âme centrale formée d'une partie supérieure cylindrique 30 suivie d'une partie tronconique 32 qui se prolonge vers le bas par une seconde partie tronconique 34 moins inclinée que la partie
20 tronconique 32 par rapport à l'axe longitudinal yy' du renfort 29. La périphérie de celui-ci est recouverte d'un produit 9' possédant les propriétés telles que définies précédemment dans les deux exemples décrits. Dans ces conditions, la mise en place du renfort 29 se réalise ainsi que décrit ci-après.

25 Après avoir dégagé le canal dentaire 3 de la dent 1, on introduit à force le renfort 29 dans celui-ci, si bien qu'au cours de cet effort le produit 9' flue et remplit les cavités comprises entre le canal dentaire 3, la cuvette 22 de la dent 1

et la partie centrale du renfort 29. Comme précédemment, cette mise en place étant effectuée, on éclaire le produit 9' au moyen d'une source de lumière visible S de façon à le faire durcir et assurer ainsi la fixation du renfort 29 dans la dent 1.

5 Suivant l'invention, le produit durcissable peut également être constitué d'un produit autopolymérisable sous l'action d'autres moyens qu'un rayonnement lumineux.

10 Dans un mode de mise en oeuvre de l'invention les moyens de rigidité axiale et longitudinale sont constitués par le produit durcissable pourvu à cet effet, en sa partie centrale et sur toute sa longueur, de fibres longues qui sont noyées dans celui-ci.

15 Dans un autre mode de mise en oeuvre de l'invention, les moyens de rigidité axiale et longitudinale comportent des fibres optiques dans l'axe central.

REVENDECATIONS

1.- Renfort dentaire destiné à être mis en place, notamment, dans une cavité dentaire (3,22), caractérisé en ce qu'il comporte des moyens de rigidité axiale et longitudinale
5 (7,7',11,30), dont au moins la partie destinée à être fixée dans ladite cavité (3,22), comporte, au moins en périphérie, un produit durcissable (9,9') en mesure de fluer sous l'action d'une contrainte, de façon à épouser la forme des parois de la cavité (3,22) dans laquelle il est mis en place, ce produit étant apte à
10 durcir, après son introduction dans ladite cavité (3,22).

2.- Renfort suivant la revendication 1 caractérisé en ce qu'il est constitué d'un tenon dentaire (5).

3.- Renfort suivant la revendication 1 caractérisé en ce qu'il est constitué d'un faux moignon dentaire (20).

15 4.- Renfort suivant l'une des revendications précédentes caractérisé en ce qu'il comporte une partie antérieure (34) formant tenon, destinée à prendre place dans le canal (3) d'une dent (1), et une partie postérieure (30) formant un faux moignon dentaire.

20 5.- Renfort suivant l'une des revendications précédentes caractérisé en ce que les moyens de rigidité axiale et longitudinale (7,7',11,30) sont constitués d'un noyau formé notamment de fibres longues (11) noyées dans une résine de synthèse.

25 6.- Renfort suivant la revendication 5 caractérisé en ce que les fibres (11) sont des fibres transparentes, telles que des fibres de verre ou de quartz.

7. Renfort suivant l'une quelconque des revendications précédentes caractérisé en ce que le produit durcissable (9,9') est un produit photopolymérisable.

8.- Renfort suivant les revendication 1 à 6 caractérisé en ce que le produit durcissable est un produit autopolymérisable.

9.- Renfort suivant l'une quelconque des revendications précédentes caractérisé en ce que le produit durcissable est une résine du type triéthylène glycol diméthacrylate.

10 10.- Renfort suivant l'une des revendications 1 à 7 caractérisé en ce que le produit durcissable est une résine du type bisphénol aglycidyl diméthacrylate.

11.- Renfort suivant l'une des revendications précédentes caractérisé en ce que les moyens de rigidité axiale et 15 longitudinale sont constitués par le produit durcissable (9,9') pourvu à cet effet, en sa partie centrale et sur toute sa longueur, de fibres longues (11) qui sont noyées dans celui-ci.

12.- Renfort suivant l'une quelconque des revendications précédentes caractérisé en ce que les moyens de rigidité axiale 20 et longitudinale comportent des fibres optiques dans l'axe central.

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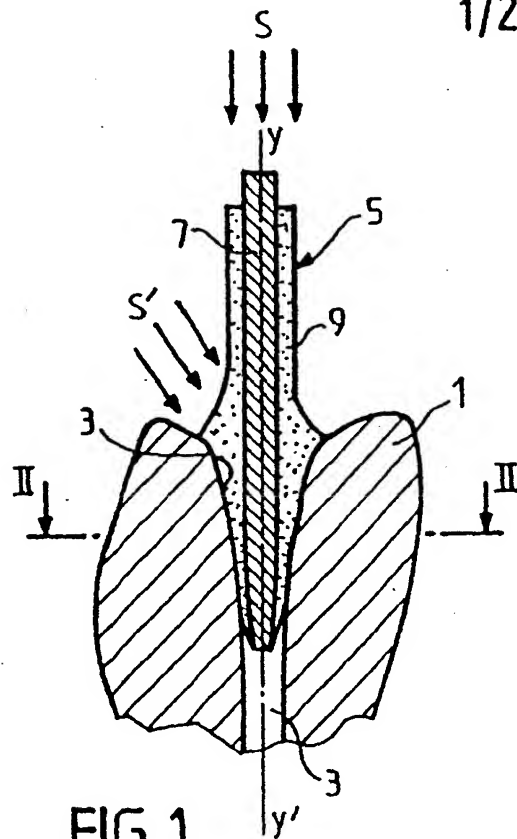


FIG. 1

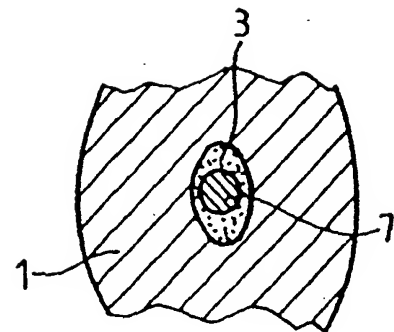


FIG. 2

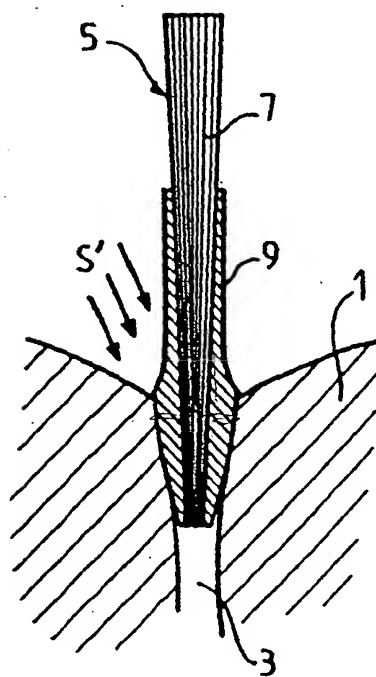


FIG. 3

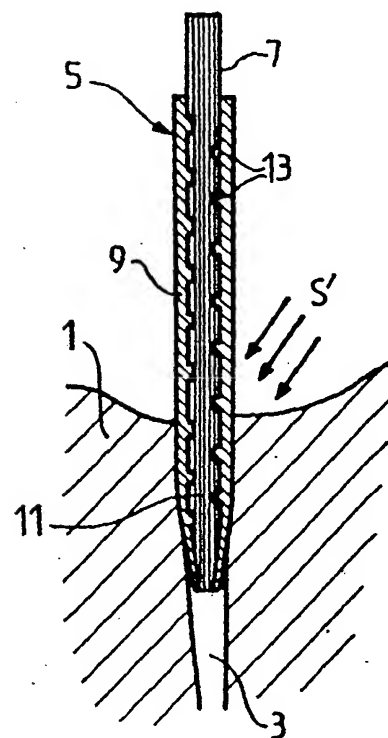


FIG. 4

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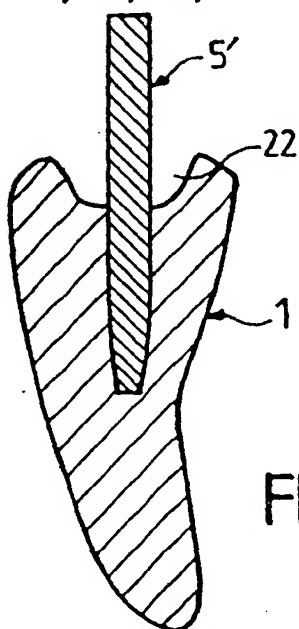
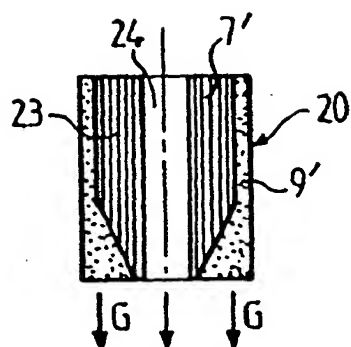


FIG. 5

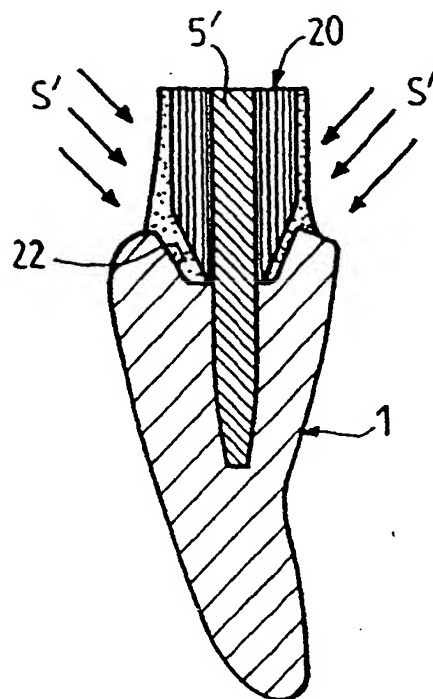


FIG. 6

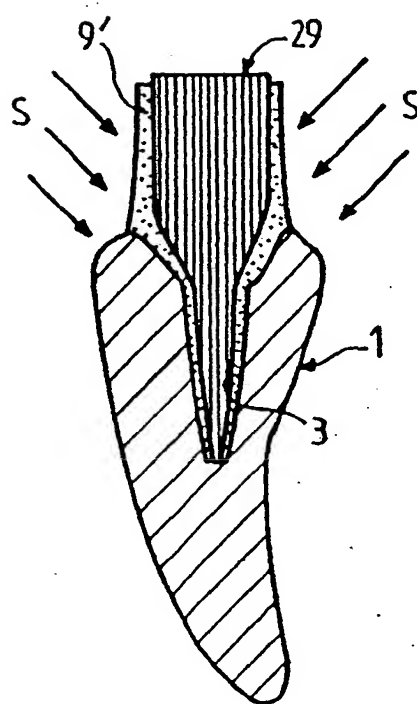
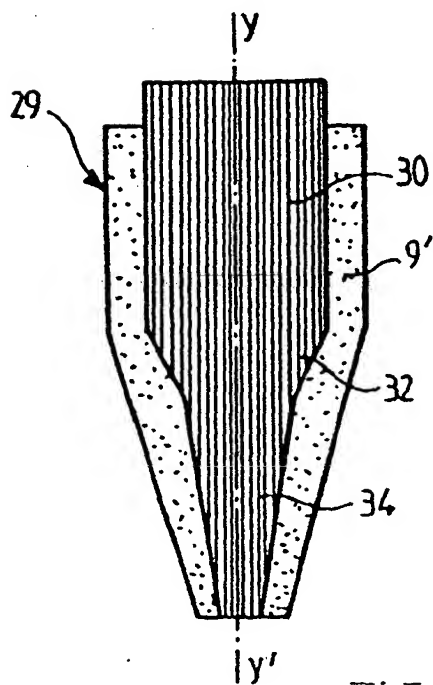


FIG. 7

RAPPORT DE RECHERCHE
PRELIMINAIRE

établi sur la base des dernières revendications
déposées avant le commencement de la recherche

2730627

N° d'enregistrement
national

FA 511302
FR 9501870

DOCUMENTS CONSIDERES COMME PERTINENTS		Revendications concernées de la demande examinée
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	
X	FR-A-2 669 211 (BERNADAT) * le document en entier *	1,2,5,6, 8,11,12
X	DE-A-38 25 601 (STROBL) * le document en entier *	1,3-7,12
A	US-A-4 696 646 (MAITLAND) * le document en entier *	1,3,7
A	US-A-1 397 067 (WILLIAMS) * le document en entier *	1,2
A	FR-A-2 493 698 (DENTALPHY) * le document en entier *	1,2
		DOMAINES TECHNIQUES RECHERCHES (brev. CL. 6)
		A61C
Date d'achèvement de la recherche		Examinateur
6 Novembre 1995		Vanrunxt, J
<p>CATÉGORIE DES DOCUMENTS CITES</p> <p>X : particulièrement pertinent à lui seul Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie A : pertinent à l'encontre d'au moins une revendication ou arrière-plan technologique général O : divulgation non-écrite P : document intercalaire</p> <p>T : théorie ou principe à la base de l'invention E : document de brevet bénéficiant d'une date antérieure à la date de dépôt et qui n'a été publié qu'à cette date de dépôt ou qu'à une date postérieure. D : cité dans la demande L : cité pour d'autres raisons A : membre de la même famille, document correspondant</p>		

This invention concerns a dental reinforcing piece, and specifically a post, whose external shape can take the shape of the cavity or canal of the tooth where you want to attach it.

It is known that in odontology, posts made of metal or composite material are used to make a restoration of a depulped tooth.

These posts, however they are made, have a circular straight section, so that when they are placed in dental canals whose straight section has a different shape, they are supported only by a small part of their external surface against the internal wall of the tooth. The mechanical locking of the post is therefore not effective, so the locking must sometimes be refined by inserting various restoration or sealing products in the free spaces between the tooth and the post.

Indeed, when the practitioner wants to achieve perfect adjustment of the post in an ovoid dental canal, he is forced to take a very precise impression of the canal, for example of silicone, and to have a laboratory make a so-called anatoform post prosthesis of cast metal, which has the disadvantage of being expensive and requiring three successive operations, which are sources of imprecision, namely taking a very precise impression, making a wax post in said impression and finally casting the post in metal with the risk of overdimensioning in the casting.

The purpose of this invention is to improve both the ease and the quality of placement of a dental reinforcing piece by proposing a reinforcing piece that can take the shape of the cavity, or dental canal, where you want to place it.

The purpose of this invention is therefore a dental reinforcing piece intended to be placed, in particular, in a dental cavity, characterized by the fact that it has means of axial and longitudinal rigidity, of which at least the part designed to be fixed in said cavity has, at least on the periphery, a product that can harden and yield under stress, so as to take

the shape of the walls of the cavity in which it is placed, and the product is capable of hardening after it is inserted into said cavity.

According to the invention, the reinforcing piece can be composed specifically of a post, or a false stump that can adapt to a post made integral with a tooth. The reinforcing piece can also be composed of a single piece forming both the post and the false stump.

In one embodiment of the invention, the means of axial and longitudinal rigidity are composed of a rigid nucleus made particularly of long fibers saturated with a synthetic resin. Such fibers can preferably be transparent, hence glass or quartz fibers, in particular, will be used.

In another embodiment of the invention, said reinforcing piece is the type that can be hardened by polymerization under the action of light radiation. This embodiment is especially interesting in that it allows the practitioner to use all the time necessary for him to place the reinforcing piece in his patient's tooth and to make the hardening product yield in the dental cavity it is designed to fill during said placement.

According to the invention, the product can also be the type that can harden by chemical reaction or by the effect of high-frequency or microwave radiation.

One embodiment of this invention will be described below, as a non-limiting example, with reference to the attached drawings in which:

Figure 1 is an axial and longitudinal sectional view of the reinforcing piece in the invention, composed of a post placed in a dental canal.

Figure 2 is a transverse sectional view of the post shown in Figure 1 along line II-II in that figure.

Figure 3 is an axial and longitudinal sectional view of a variation of embodiment of the reinforcing piece in the invention composed of a post.

Figure 4 is an axial and longitudinal sectional view of another variation of embodiment of the reinforcing piece in the invention composed of a post.

Figure 5 is an axial and longitudinal sectional view of the reinforcing piece in the invention, composed of a false stump, before it is placed on a post made integral with a tooth.

Figure 6 is an axial and longitudinal sectional view of a tooth equipped with the false stump shown in Figure 5.

Figure 7 is an axial and longitudinal sectional view of a variation of embodiment of the reinforcing piece in the invention, forming both the post and a false stump before it is placed in a tooth.

Figure 8 is an axial and longitudinal sectional view of the reinforcing piece shown in Figure 7 after it is placed in the tooth.

Figure 1 shows a tooth 1 having an ovoid canal 3, the upper part of which has been enlarged to house the post 5 in the invention.

The post 5 is composed of a central, longitudinal core 7 of axis yy' , which is transparent and made up of a bundle of long fibers, such as quartz or glass fibers, which are saturated with a matrix of hardenable resin, particularly a transparent resin such as an epoxy resin.

The periphery of the core 7 is covered with a malleable product 9 having the property of hardening due to the action of luminous radiation, particularly radiation whose wavelength is such that it is located in the range of visible light. These types of

products are well known in dental technology, and a triethylene glycol dimethacrylate resin (called TEGDMA) or a bisphenol aglycidyl dimethacrylate resin (BISGMA) can also be used.

The hardenable product 9 will be given characteristics so it can be deformed and can yield easily when subjected to pressure, so that when the post 5 takes its place in the canal 3, it can fill the empty space around it.

To give the hardenable product the necessary compactness, microcharges, particularly pyrogenic or colloidal silica, can be added to it, which will make it possible to give it thixotropic characteristics.

Said hardenable product can be charged, besides with silica charges, with charges such as short fibers located and oriented randomly in said product. Depending on the specific application, macrocharges composed particularly of quartz particles or hollow glass microspheres can also be added to the product. Preferably, according to the invention, the different charges contained in the product will be composed of transparent materials.

Under these conditions, the invention will be used as described below.

Once the practitioner has finished preparing the tooth canal 3, etching and drying it, he applies an adhesive finish called a "primer" and an adhesive to the external wall of the post 5, and to the canal walls; then he inserts it into the dental canal 3. Due to the force of application necessary for good placement of the post 5, the parts of the hardenable product 9 that encounter the walls of the canal 3 yield and thus fill the empty space between the post 5 and the internal wall of the canal 3, which makes it possible to fill orifices, specifically oval type orifices, as shown in Figure 2. After the practitioner has tested the correct placement of the post 5, he lights the external end of it using a light source S, particularly a source of radiation with a wavelength in the visible range, for the time necessary for the product 9 to harden completely. The light rays follow the

transparent core 7 of the post 5 to light, on their passage and inside, the external sheath of the photo-hardenable product 9, which ensures its hardening. From then on, the locking of the post 5 is thus ensured.

When the hardenable product 9 is transparent in nature, as specified previously, the practitioner can then induce photo-polymerization with light, as shown in Figure 1, from a light source S' located near the junction between the post 5 and the surface of the tooth 1. This location makes it possible to obtain more effective action of light radiation on the hardenable product 9, since the trajectory of the radiation through the post is shorter.

As shown in Figure 3, it is not necessary for the hardenable product 9 to be applied in equal thickness over the whole periphery of the central core 7 of the post 5. It is thus possible to limit it to being applied only to the so-called canal part of the post 5, that is, the part that is intended to be placed in the dental canal 3. Such placement makes it very easy to use in terms of grasping.

In another embodiment of the invention shown in Figure 4, the post 5 has a rigid core 7 made up of long transparent fibers 11 which extend over its entire length. These long fibers 11 give the post the rigidity that is necessary to place it in the dental canal 3. Retentions 13, obtained particularly by machining, have been made around the core 7 to create rough places on its periphery for the hardenable product 9 to hook onto.

As shown in Figures 5 and 6, the reinforcing piece in the invention can also be composed of a false stump 20, which is designed to be placed on a post 5' attached in a tooth 1. For this purpose, the upper part of the tooth 1 surrounding the post 5 is hollowed out of a cavity 22 designed to take the base of the false stump 20.

The latter is composed of a rigid core 23 whose lower part has a truncated shape and is hollowed out of an axial and longitudinal canal 24, with an internal diameter corresponding to the external diameter of the post 5', so that the false stump 20 can go through it. The periphery 9' of the false stump 20 is covered with a product 9' that can

yield and has the property of hardening under the action of light radiation, particularly visible or ultraviolet radiation, the type used in the preceding embodiment. This product extends over the entire height of the false stump 20, so the outer shape of it is cylindrical and its lower part has a larger quantity of hardening product 9'.

Under these conditions, the false stump 20 is placed on the tooth as specified below.

The false stump 20 goes over the post 5', so its axial canal 24 receives it, and is pushed hard against the tooth 1, in the direction of arrow G, so that, under this force, the product 9' yields and fills the space between the outer walls of the cavity 22 and those of the false stump 20. As mentioned before, the product 9' is then lighted using light radiation, particularly visible or potentially ultraviolet radiation, to make it harden. This makes it especially fast and easy to seal a false stump on a tooth, in which all the free spaces existing between the tooth and the false stump are filled with a hardened product so the false stump is held very effectively on the post 5' and the tooth 1.

In one variation of embodiment, shown in Figures 7 and 8, the reinforcing piece 29 in the invention is composed of both a post sealed in the tooth and a false stump. Thus, in Figure 7, the reinforcing piece 29 is composed of a central core made up of a cylindrical upper part 30 followed by a truncated part 32 which extends downward with a second truncated part 34 less inclined than truncated part 32 in relation to the longitudinal axis yy' of the reinforcing piece 29. Its periphery is covered with a product 9' having the properties defined before in the two examples described. Under these conditions, the reinforcing piece 29 is placed as described below.

After the tooth 1 is removed from the dental canal 3, the reinforcing piece 29 is forced into it, causing the product 9' to yield and fill the cavities between the dental canal 3, the basin 22 of the tooth 1 and the center part of the reinforcing piece 29. As before, when this placement is done, the product 9' is lighted with a visible light source S so as to make it harden and make sure the reinforcing piece 29 is fixed in the tooth 1.

According to the invention, the hardenable product can also be composed of a product that can self-polymerize by the action of means other than light radiation.

In one embodiment of the invention, the means of axial and longitudinal rigidity are composed of the hardenable product provided for that purpose, its center part and over its entire length, long fibers which are saturated with it.

In another embodiment of the invention, the means of axial and longitudinal rigidity have optic fibers in the center axis.

CLAIMS

1. – A dental reinforcing piece designed to be placed, particularly, in a dental cavity (3, 22) characterized by the fact that it has means of axial and longitudinal rigidity (7,7',11,30), of which at least the part designed to be fixed in said cavity (3,22) has, at least on its periphery, a hardenable product (9,9') that can yield under stress, so as to take the shape of the walls of the cavity (3,22) in which it is placed, and this product can harden after it is inserted into said cavity (3,22).

2. – The reinforcing piece in Claim 1, characterized by the fact that it is composed of a dental post (5).

3. – The reinforcing piece in Claim 1, characterized by the fact that it is composed of a false dental stump (20).

4. – The reinforcing piece in one of the preceding claims, characterized by the fact that it has an anterior part (34) forming a post, designed to be placed in the canal (3) of a tooth (1), and a posterior part (30) forming a false dental stump.

5. – The reinforcing piece in one of the preceding claims, characterized by the fact that the means of axial and longitudinal rigidity (7,7',11,30) are composed of a nucleus made specifically of long fibers (11) saturated with a synthetic resin.

6. – The reinforcing piece in Claim 5, characterized by the fact that the fibers (11) are transparent fibers, such as glass or quartz fibers.

7. – The reinforcing piece in any one of the preceding claims, characterized by the fact that the hardenable product (9,9') is a photo-polymerizable product.

8. – The reinforcing piece in Claims 1 to 6, characterized by the fact that the hardenable product is a self-polymerizable product.

9. – The reinforcing piece in any one of the preceding claims, characterized by the fact that the hardenable product is a triethylene glycol dimethacrylate-type resin.

10. – The reinforcing piece in one of Claims 1 to 7, characterized by the fact that the hardenable product is a bisphenol aglycidyl dimethacrylate-type resin.

11. – The reinforcing piece in one of the preceding claims, characterized by the fact that the means of axial and longitudinal rigidity are composed of the hardenable product (9,9') provided for that purpose, in its central part and over its entire length, made of long fibers (11) which are saturated with it.

12. – The reinforcing piece in any one of the preceding claims, characterized by the fact that the means of axial and longitudinal rigidity have optical fibers in the center axis.



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Attach to
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2730607**United States Patent** [19]

Reynaud et al.

[11] Patent Number: **5,989,032**[45] Date of Patent: **Nov. 23, 1999**[54] **SELF-LOCKING DENTAL
REINFORCEMENT**[75] Inventors: **Marc Reynaud, Meylan; Pierre-Luc
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Dentaires R.T.D., Saint-Egreve, France**

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[21] Appl. No.: **08/894,002**[22] PCT Filed: **Feb. 16, 1996**[86] PCT No.: **PCT/FR96/00254**§ 371 Date: **Aug. 11, 1997**§ 102(e) Date: **Aug. 11, 1997**[87] PCT Pub. No.: **WO96/25119**PCT Pub. Date: **Aug. 22, 1996**[30] **Foreign Application Priority Data**

Feb. 17, 1995 [FR] France 95 01870

[51] Int. Cl.⁶ **A61C 5/04**[52] U.S. Cl. **433/224; 433/220**[58] Field of Search **433/220, 221,
433/225, 226, 224**[56] **References Cited****U.S. PATENT DOCUMENTS**

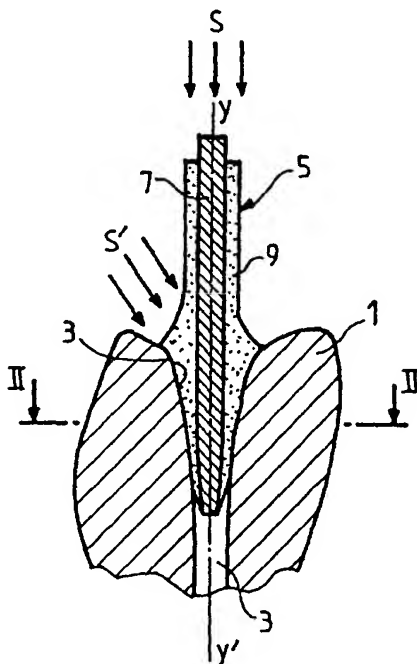
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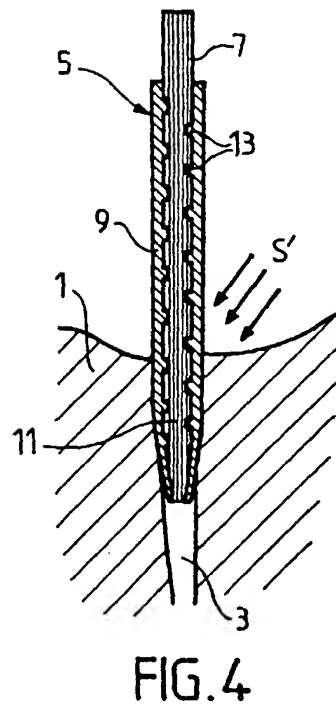
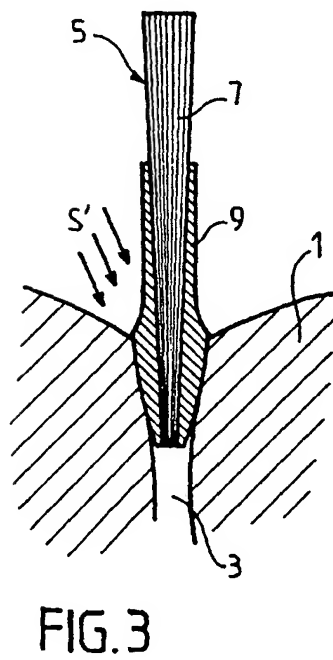
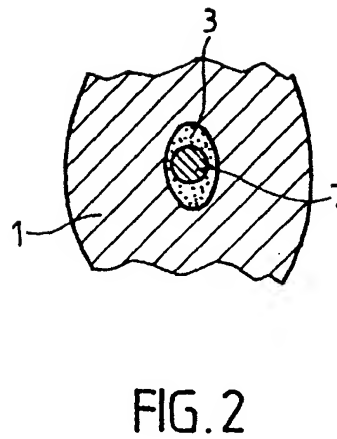
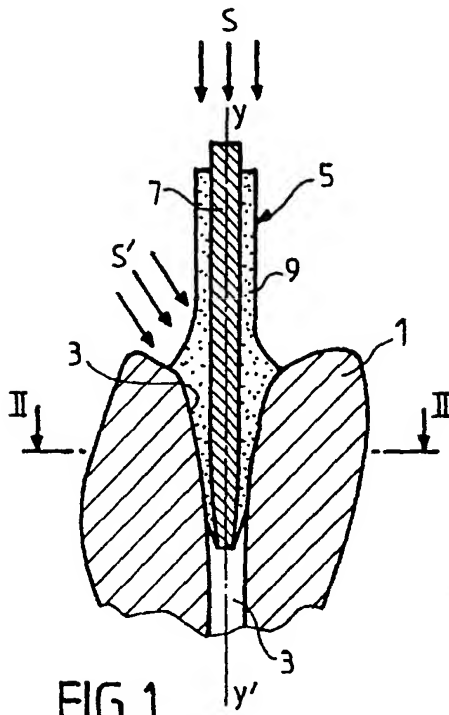
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Primary Examiner—Ralph A. Lewis*Attorney, Agent, or Firm*—Young & Thompson[57] **ABSTRACT**

Dental post to be fitted, particularly, within a dental cavity (3) comprises axial and longitudinal stiffening elements (7). At least a portion of the stiffening elements which is to be fixed within the cavity (3) comprises, at least at its periphery, a curable product (9) capable of yielding under an applied force so as to conform to the walls of the cavity in which it is located. The product is curable after being introduced into the cavity.

11 Claims, 2 Drawing Sheets



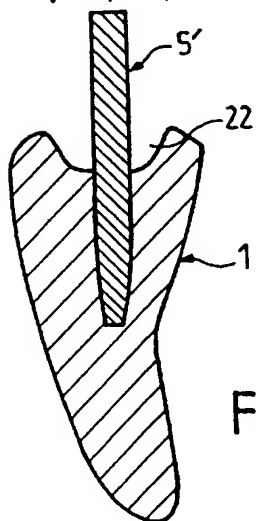
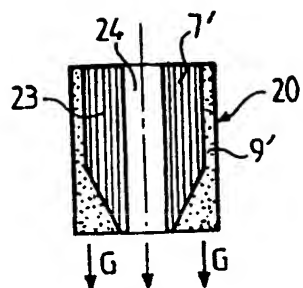


FIG. 5

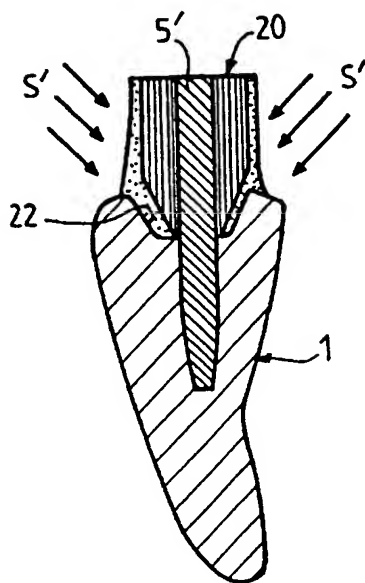


FIG. 6

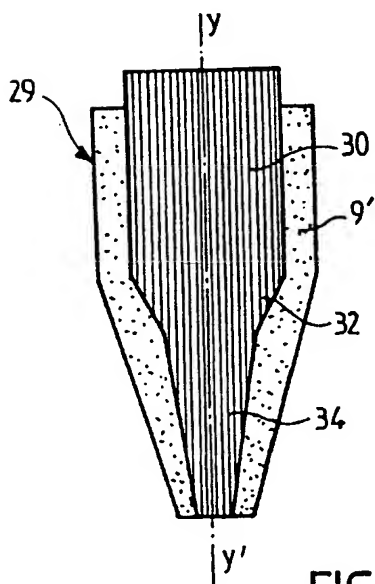


FIG. 7

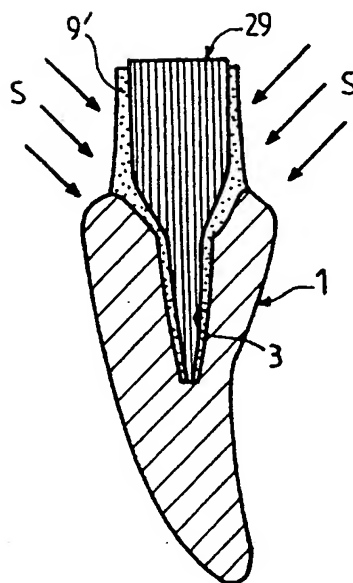


FIG. 8

SELF-LOCKING DENTAL REINFORCEMENT

FIELD OF THE INVENTION

The present invention relates to a dental reinforcement, in particular a post, whose outer shape is able to fit the contour of a cavity, or of the root canal, of a tooth to which it is to be fixed.

BACKGROUND OF THE INVENTION

In odontology posts are known to be used in metal or a composite material to reconstruct a root treated tooth.

These posts, of whatever material they are made, have a circular cross-section which means that when they are placed in dental root canals whose cross-section is of a different shape, only a small part of their outer surface comes into contact with the inner wall of the tooth. Mechanical locking of the post is therefore not fully effective, and it is sometimes necessary to improve the lock by inserting various reconstruction or cementing products into the free spaces between the tooth and the post.

If the practitioner wishes to achieve a perfect fit of the post inside an ovoid root canal, a very precise root canal impression has to be made for example in silicon which is forwarded to a prosthesis laboratory to have a so-called anatiform post made of cast metal, which has the disadvantage of being costly and requires three successive procedures which can be a source of imprecision, these being taking an impression of high accuracy, making a wax post in this impression and finally casting the metal post with the risk of over-sizing at the time of casting.

Patent FR-A-2 669 211 proposed filling the spaces between the post and the root canal with an injection of setting resin which also bonds the post to the canal. One disadvantage of this technique is that the extent of shrinkage which takes place in the resin during setting increases with the mass of resin. Under these conditions the shrinkage which occurs in different places within the root canal can be extensive and creates areas in which bonding is not satisfactory.

Document DE-A-3 825 601 also describes a dental post whose upper end is provided with a part of truncated cone shape forming a core of greater diameter intended to reconstruct a deteriorated tooth. This dental post is positioned in the root canal of the tooth and is made up of a synthetic product containing fibres which may be carbon or glass fibres. This type of post is fixed in the root canal of the tooth by bonding or cementing means. Such device has drawbacks similar to those described in the document mentioned previously.

The purpose of the present invention is to remedy such drawbacks. This invention therefore sets out to improve both the ease and quality of applying reinforcements to a dental cavity. One particular purpose of the present invention is to propose a dental reinforcement which is able to fit the contour of the cavity, or root canal, in which it is to be positioned.

SUMMARY OF THE INVENTION

The aim of the present invention is therefore a dental reinforcement intended to be placed in particular in a dental cavity, characterized in that it comprises means of longitudinal rigidity of which at least the part intended to be fixed inside said cavity comprises, at least on its periphery, a setting product able to flow under stress so that it follows the

contour of the walls of the cavity in which it is placed, said product being able to set after it has been placed in said cavity.

In accordance with the invention, the reinforcement may in particular be a post, or a core which can be fitted to a post bonded to a tooth. The reinforcement may also be made up of a single part which constitutes both the post and the core.

In one embodiment of the invention, the means of longitudinal rigidity are made up of a rigid nucleus formed in particular of long fibres embedded in a synthetic resin. Such fibres may, preferably, be transparent and particular use is made of glass or quartz fibres or optic fibres.

Under another embodiment of the invention said reinforcement is of a type which sets by polymerization under the action of a light ray. This embodiment is of particular interest as it provides the practitioner with all the time that is needed to position the reinforcement in the patient's tooth and allow the setting product to flow during said positioning into the dental cavity it is intended to fill.

According to the invention, the product may also be of a type which sets by chemical reaction or under the effect of high frequency or micro-wave radiation.

A further purpose of this invention is a method of inserting a dental reinforcement in a dental cavity, characterized in that it comprises the following stages:

covering, at least around its periphery, a longitudinal rigid element with a setting product able to flow under stress, placing said reinforcement made in this way inside the cavity in such manner as to allow said product to flow under the stress resulting from the application of the reinforcement inside the cavity so that it follows the contour of the walls of the cavity in which it is placed, causing said product to set at least in part, withdrawing said reinforcement from the cavity, placing a cementing product in said cavity and/or along the periphery of said reinforcement, re-placing the reinforcement inside the cavity so that it is cemented into place.

With this method it is possible to finish the setting of said product covering the element of longitudinal rigidity of the reinforcement, outside the tooth cavity, and in particular in an oven, which allows the setting operation to be closely controlled so that the reinforcement can be given strong rigid properties.

BRIEF DESCRIPTION OF THE DRAWINGS

A form of embodiment is described below for illustration purposes which is non-restrictive and refers to the appended drawing in which:

FIG. 1 is an axial, longitudinal section view of a reinforcement of the invention made up of a post placed in a root canal.

FIG. 2 is a transverse section view of the post represented in FIG. 1 along line II—II of the latter.

FIG. 3 is an axial, longitudinal section view of a variant of use of a reinforcement according to the invention made up of a post.

FIG. 4 is an axial, longitudinal view of another variant of use of a reinforcement according to the invention made up of a post.

FIG. 5 is an axial, longitudinal view of a reinforcement according to the invention made up of a core before it is placed on a post bonded to a tooth.

FIG. 6 is an axial, longitudinal view of a tooth fitted with a core shown in FIG. 5.

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FIG. 7 is an axial, longitudinal view of a variant of use of a reinforcement according to the invention which forms both a post and a core before it is placed in a tooth.

FIG. 8 is an axial, longitudinal view of a reinforcement shown in FIG. 7 after it has been placed in the tooth.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a tooth 1, comprising an ovoid canal 3 whose upper part has been enlarged so that it can house a post 5 of the invention.

Post 5 is made up of a central, longitudinal nucleus with an axis yy' which is transparent and made up of a bundle of long fibers, such as quartz or glass fibers, which are embedded in a setting resin matrix, in particular a transparent resin such as an epoxy resin.

The periphery of nucleus 7 is covered by a malleable product 9 having the property of adhering to nucleus 7 and of setting under the action of a light ray, in particular a ray whose wavelength is such that it is located in visible light. Products of this type are fully known in dental art and particular use may be made of a triethylene glycol dimethacrylate resin (so-called TGDMA) or a bisphenol aglycidyl dimethacrylate resin (so-called BISGMA).

Characteristics are given to setting product 9 such that it may be deformed and flow easily when it is subjected to stress, so that, when post 5 is positioned in canal 3, it is able to fill the empty volume surrounding it.

In order to give the setting product the required compactness, microloads may be added to it, in particular pyrogenated or colloidal silica which will give it thixotropic characteristics.

Also said setting product may be loaded, in addition to silica loads, with loads such as short fibers placed in random position and direction in said product, or long fibers wound for example around axial and longitudinal means of rigidity. Depending upon specific applications, macroloads may also be added to the product made up in particular of quartz particles or hollow glass microspheres. Preferably, according to the invention, the loads placed in the setting product are made up transparent materials. According to the invention, the loads whether made up of silica or fibers, are used to provide control over the fluid, malleable nature of the product which will determine its flow capacity when the post is set in place. In the present example, the product is a setting product which is set by photopolymerization.

Under these conditions the invention is put to use as described below.

When the practitioner has finished the canal preparation of root canal 3 after acid etch and drying, an adhesive "Primer" and an adhesive is applied to the outer wall of post 5 and to the walls of the canal. Post 5 is then placed in root canal 3. Under the effect of the application force required for the proper positioning of post 5, the parts of setting product 9 which meet the walls of canal 3 flow and consequently come to fill the empty spaces between post 5 and the inner wall of canal 3, which allows spaces of substantial volume to be filled, in particular those of ovoid shape, as shown in FIG. 2. After controlling the correct positioning of post 5, the practitioner projects light onto the outer end of the latter using a light source S, in particular a source of rays whose wavelength is in visible light, for the time that is necessary to achieve complete setting of product 9. The light rays follow transparent nucleus 7 of post 5 to light up during their passage and from within the outer sheath of photopolymer-

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izable product 9, thereby causing the latter to set. Post 5 is thereby locked in position.

When setting product 9 is of transparent type, as specified above, the practitioner can carry out photopolymerization of the product by directly applying light to its outer surface as shown in FIG. 1, with a source of light S' placed in the proximity of the junction between post 5 and the surface of tooth 1. In this way it is possible to obtain more effective action of the light ray on setting product 9 as the pathway of the ray through the post is shorter.

As shown in FIG. 3, it is not necessary for setting product 9 to be deposited in an equal layer over the entire periphery of central nucleus 7 of post 5. It need only be deposited on the so-called root canal part of post 5, that is to say the part intended to be placed in root canal 3. Such possibility provides extensive ease of use in respect of prehension.

The positioning of the post inside the dental cavity may also be made as described below. During a first stage, the post of the invention is positioned in the root canal as described previously, so that the parts of the setting product which come into contact with the canal walls flow under the effect of stress and perfectly line the canal contour. In a second stage, the product is caused to set, which may be partial, and the post is withdrawn from the cavity. For this purpose it is possible, before the post is positioned, to deposit in the dental cavity and/or on the post a product which facilitates the latter's removal from the "mould", such as in particular Vaseline. One therefore has in hand a post whose outer contour corresponds to that of the root canal with the exception of a few deformations due to shrinkage of the product during setting (these deformations being lesser than those produced in the prior art as mentioned above). If the setting of the product is not completed, it is possible to complete setting outside the patient's mouth, in an oven for example. It is therefore possible in accordance with the invention to harden the post thus formed only as much as is necessary for it to be withdrawn without being deformed, and the setting stage can subsequently be completed outside the patient's mouth with means known to the prior art, which allow optimal hardening of the post to be achieved. The final stage entails cementing the post in the dental cavity, in conventional manner, using a cementing product. For this purpose, this product may be placed both in the root canal and around the periphery of the post, so that the few spaces left by the slight shrinkage of the product may be easily offset.

In a further embodiment of the invention shown in FIG. 4, post 5 comprises a rigid nucleus 7 formed of transparent long fibres 11 which extend over its entire length. These long fibres 11 confer upon the post the rigidity required for its positioning in dental canal 3. Retainers 13 obtained in particular through machining, are made around nucleus 7 in such manner as to form small projections around the periphery of the latter to enhance the adhesion of setting product 9.

As shown in FIGS. 5 and 6, the reinforcement of the invention may also be made up of a core 20 intended to be placed on a post 5' fixed in a tooth 1. For this purpose the upper part of tooth 1 surrounding post 5 is hollowed to form a cavity 22 intended to house the base of core 20.

The latter is made up of a rigid nucleus 23 whose lower part is of truncated cone shape hollowed by an axial longitudinal canal 24, whose inner diameter corresponds to the outer diameter of post 5', in such manner that core 20 is able to be slipped over the latter. Periphery 9' of core 20 is covered by a product 9' able to flow which has the property

of setting under a light ray in particular a visible or ultraviolet ray of the type used in the previous embodiment. This product extends over the entire height of core 20 so that the outer shape of the latter is of cylinder shape and its lower part comprises a greater quantity of setting product 9'. 5

Under these conditions the positioning on the tooth of core 20 is carried out as specified below.

Core 20 is placed over post 5' so that its axial canal 24 houses the latter, and is strongly pressed against tooth 1 with stress being exerted in the direction of arrows G so that, under this stress, product 9' flows and fills the space between the outer walls of cavity 22 and the walls of core 20. As described previously, light is applied to product 9' using a light ray, in particular a visible or possibly an ultraviolet ray, so as to cause the product to set. With this particularly easy, quick method the core can be cemented to the tooth in a manner in which all the free spaces existing between the tooth and the core are filled with a product that has set, so that the core is held in particularly effective manner onto post 5' and tooth 1.

In a variant of embodiment shown in FIGS. 7 and 8, a reinforcement 29 of the invention is made up both of a post bonded in the tooth and of a core. Therefore in FIG. 7, reinforcement 29 is made up of a central nucleus comprising a upper cylindrical part 30 followed by a part of truncated cone shape 32 which is extended downwards by a second part of truncated cone shape 34 that has a smaller angle of slant than part 32 in relation to longitudinal axis yy' of reinforcement 29. The periphery of the latter is covered by a setting product 9' having the properties previously described in the two examples given above. Under these conditions the positioning of reinforcement 29 is carried out as described below.

After clearing root canal 3 of tooth 1, reinforcement 29 is pressed into canal 3 so that under the force applied, setting product 9' flows and fills the cavities between dental canal 3, floor 22 of tooth 1 and the central part of reinforcement 29. As previously, after this placing in position, light is applied to setting product 9' using a source of visible light S to cause it to set thereby fixing reinforcement 29 in tooth 1. 40

According to the invention, the setting product may also be a product which self-polymerises under the action of means other than a light ray. The product may for example by set under the effect of a rise in temperature, in particular to a temperature above normal human body temperature. The extent of setting obtained may be full or partial as described previously. 45

In one embodiment of use of the invention, the means of longitudinal rigidity are made up of the setting product whose central part is provided for this purpose, and over its entire length, with long fibres that are embedded in it. 50

In another embodiment of use of the invention, the means of longitudinal rigidity comprise optic fibres in the central axis. 55

Also, the setting product may contain fibres which, like the loads, can allow control over flow qualities. These fibres may be short fibres, in particular positioned at random, or long fibres positioned longitudinally or wound around the rigid nucleus of the reinforcement. 60

What is claimed is:

1. Dental reinforcement intended to be placed in a dental cavity comprising:

longitudinally extending stiffening means, having a part intended to be fixed in said cavity, for providing rigidity to said cavity;

said part having a periphery which comprises thereon a photopolymerizable setting product structured and arranged:

(a) to flow in a first dental cavity insertion mode under the effect of stress, in such a manner as to follow the contour of the walls of the cavity in which the dental reinforcement is positioned;

(b) to set in a second mode after placed in said cavity and subjected to light rays; and

(c) to adhere to said periphery and to be removable from said cavity with said stiffening means in a third mode.

2. The dental reinforcement according to claim 1, wherein the dental reinforcement is in the form of a dental post which comprises the longitudinally extending stiffening means.

3. The dental reinforcement according to claim 1, wherein the dental reinforcement comprises a dental core for placement on the longitudinal extending stiffening means, said dental core having an axial longitudinal canal for accommodating the longitudinally extending stiffening means therethrough.

4. The dental reinforcement according to claim 1, wherein the dental reinforcement comprises an anterior part forming a post, intended to be placed in a root canal of a tooth, and a posterior part forming a dental core.

5. The dental reinforcement according to claim 1, wherein the stiffening means comprise a nucleus formed by transparent long glass or quartz fibers embedded in a synthetic resin.

6. The dental reinforcement according to claim 5, wherein the stiffening means comprise optic fibers.

7. The dental reinforcement according to claim 1, wherein the setting product contains pyrogenated or colloidal silica.

8. The dental reinforcement according to claim 7, wherein the setting product further contains short fibers.

9. The dental reinforcement according to claim 7, wherein the setting product further contains long fibers.

10. The dental reinforcement according to claim 9, wherein the long fibers are wound around the stiffening means.

11. Method of placing a dental reinforcement in a dental cavity which comprises the following stages:

providing a longitudinal rigid element having a periphery; covering at least the periphery of the longitudinal rigid element with a photopolymerizable setting product able to flow under the action of a stress to obtain a dental reinforcement;

placing said reinforcement inside the cavity so as to cause said product to flow under the effect of stress resulting from the positioning of the reinforcement in the cavity, said product following the contour of the walls of the cavity in which the dental reinforcement is positioned; subjecting said photopolymerizable product to light rays in order to set, at least in part;

withdrawing said reinforcement from the cavity;

placing a cementing product in at least one of said cavity and on the periphery of said reinforcement; and

replacing the reinforcement in the cavity so that it may be cemented into place.

* * * * *